Information Systems Development Support (ISDS) Contract
Contract Work Order (CWO) Implemention Plan

for

CWO 18 - GMP Software Development

Developed by
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Under

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for the

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Foreword

Due to the timing of these Work Implementation Plans (WIPs) relative to (i.e., subsequent to) the start of the development effort, a slightly different approach is being used than would normally be the case. WIPs document the planning that normally precedes development. The document then grows and is modified, as necessary, to reflect a dynamic development environment. Since much of the detail already exists for tasks already in progress at the beginning of the ISDS contract, the WIP references existing detail without significant elaboration. The WIP will still act as a central repository to pull together information for a particular development task. The objective of this exercise is to provide all the information necessary to plan for and follow the development of each development task. This will be done either by inclusion or reference in the WIP with an eye on improving the total product and reducing redundancy and, thus, paper. Future WIPS will incorporate CASE and other development tools, when authorized, to reduce documentation costs and provide for the integration of the design and documentation processes into a single homogeneous process.

Preface

This is the top-level CWO document used for defining and controlling the effort, organizational structure, management authority and responsibility, and resource allocations for the CWO. This is the baseline continued enhancement and maintenance of the Metric Prediction Software CWO technical and management document developed under the guidelines set forth in DRD MA005 and in the ISDS Program Management Plan and supported by the ISDS methodology.

The **order of precedence** is the ISDS contract and attachments, then the ISDS Project Management Plan and its supporting procedures, and then this plan. The ISDS Project Management Plan and supporting procedures can be explicitly waived with the concurrence of JPL and ISDS team management. Such actions and decisions are documented in Section 11, Deviations, Exceptions, and Waivers.

Table of Contents

1. Introduction

1.1 Background

1.2 Purpose

The purpose of CWO 18 is to replace an unreliable legacy system with a UNIX & C based open system on current equipment.

1.3 Goals

JPL wants to achieve initial operability at the earliest possible date with enhancement to full functionality by September 1995.

2. SOW & Deliverables

2.1 SOW

Infotec shall provide software development support for the GCF Monitor and Control Processor (GMP) assembly, with technical direction and support from a JPL Cognizant Development Engineer (CDE), and managerial direction and support from a JPL Technical Group Supervisor (TGS).

There shall be two deliveries of the software within approximately one year. The functional and software requirements for these deliveries, as well as necessary development hardware and software, shall be provided by JPL. In cooperation with the JPL CDE, Infotec shall be responsible for design, coding, debugging, unit testing, integration testing, acceptance testing, and operations transfer of software for each delivery. Associated JPL standard documentation shall also be produced by Infotec, except where explicitly waived. All code written in the C programming language shall conform to JPL supplied coding standards. All new code shall be written in C. Existing code written in Ada may be ported where appropriate.

The GCF Monitor and Control Processor (GMP) is a new assembly, based on SUN open system UNIX workstations, running the Solaris operating system. The GMP replaces the aging and unmaintainable GCF Monitor and Control (GMC) assembly, which consists of a program written primarily in the Ada programming language running on Encore computer platforms. The GMP assembly will provide operators with a modern Graphical User Interface (GUI) for monitor and control of an array of other communications computers and equipment. The GUI interface will be accessible from any of several workstations with Ethernet LAN connectivity. A software package that facilitates creation of GUI interfaces, known as UIM/X will be available and strongly recommended for all GUI development.

Details of each delivery are provided below. (See Section 2.2.1)

2.2 Deliverables

2.2.1 CWO Specific Deliverables

Delivery #1

> Basic GMP: Provide initial delivery of the GMP to provide improved response time and a modern GUI monitor and control interface. This delivery will provide only enough basic functionality to replace the existing unreliable GMC equipment as soon as possible. It is expected that a large portion of the code will be ported from the GMC to the

GMP, with new code providing a simple GUI interface. The emphasis in this delivery will be to make it operational at the earliest possible date.

This delivery is required to be operational by May 1995 or sooner if possible.

Delivery #2

Full GMP: Deliver new GMP software which provides enhanced functionality as follows:

All of existing GMC functionality which is still required.

Redesigned top level displays to facilitate operations and maintenance.

Monitor and control of operations and test equipment via GUI windows on the GMP workstations. The GUI interface must be accessible to any authorized workstation with IP connectivity through LAN connections.

Improved monitoring and accountability of data flow on a project/stream basis. This includes monitoring data flow both through an individual node, and on an end-to-end bases.

Ability for operators to delete stream routing information for a single stream in all assemblies with a single operation.

Modifed dump utility to provided [?} pre-defined formatted dumps to screen, file, or printer for all CCT assemblies.

Ability to download configuration files from GMP to other GCF assemblies using FTP.

Support of a simple and permanent process which allows updating routing files on multiple assemblies with no machine down-time and minimal block loss.

Provide at least four levels of password security for access to monitor and control functions: (1) monitor only, (2) comm technician, (3) comm chief, and (4) system administrator.

This delivery is required to be operational by approximately September 1995, with the final schedule to be negotiated by the JPL CDE and Infotec [sp] developers.

2.2.2 Deliverables Required by Contract or Derived from the CWO

1. MA005 - CWO Implementation Plan at Class **XXX** - draft, final, and updates as required
2. MA006 - Monthly Progress Report
3. MA007 - CWO Weekly Status and Major Problems Report

3. Software Development Plan

3.1 Technical Approach

This section contains our technical approach for all phases the CWO. Part of our implementation approach is derived from our analysis of the CWO's risk items and our approach to mitigating them as documented in the Risk Management Plan. The technical aspects of the life cycle phases are discussed in the following sections:

3.1.1 Recapitulation of Requirements

We follow these conventions: 1) for traceability each requirement receives a number, 2) **bold words came directly from**

the CWO SOW, and 3) normal text is our understanding of the requirement.

3.1.1.1 Functional Requirements

F1 This is the first functional requirement

3.1.1.2 Performance Requirments

P1

3.1.1.3 Operational Requirements

O1

3.1.1.4 Management and Programmatic Requirements

M1

3.1.1.5 Special Requirements

S1 Generally, there are none and, if that is the case, state it.

3.1.1.6 Definitions

Term *definition*

3.1.2 System Operations Concept

Describe how it works and what the user does with it. A multiple scenario approach including startup, shut down, major operational modes, and error or abnormal operation is often most appropriate.

3.1.3 Level of Application of the Methodology

The attached check list summarizes our analysis of the technical and management requirements of the CWO and shows how we arrived at a Class XXX application of the ISDS methodology.

3.1.4 Overall Approach

We have chosen an approach using these available components with known reliability and functionality to significantly reduce CWO cost and risk.

First, we plan to rely heavily on standards (e.g., XWindow System, Motif, C) and standard UNIX services (e.g., TCP/IP, FTP, telnet, file manipulation, multi-tasking) to reduce cost and risk.

Second, we use *list the tools and enumerate their benefits.*

Third, we have chosen *a specific model, and build/release approach with/without rapid prototyping and given a high level description of how this reduces risk.*

Fourth, if *bad thing happens, how we get around it.*

The following subsections describe the five phases of the software development life cycle in detail with respect to the CWO and discuss the most important technical aspects each life-cycle phase.

3.1.4.1 Requirements Definition and Analysis

3.1.4.2 Architectural Design

3.1.4.3 Software Implementation

3.1.4.4 Software Integration and Test

3.1.4.5 Installation and Training

There are no special Installation and Training considerations for CWO 00. However,

Because of the size and criticality of the installation and training activities, our plan for this phase is contained in a separate document, xxxxx.

3.1.4.6 Maintenance and Sustaining Engineering

3.2 Integration & Build Approach

This section describes our overall approach for integrating software components into releases, testing release functionality, and demonstrating operability to JPL through acceptance testing. There are many possible test documents, but due to the size of the effort (*state the class of this CWO*), some aspects of test planning have been combined. The items to be generated during later stages of the CWO implementation are

3.2.1 Responsibility

xxxx is responsible for planning and coordinating overall testing and integration and will ...

3.2.2 Integration & Test Activities

Describe how the integration will occur

3.2.2.1 Integration Approach

3.2.2.2 Test Approach

3.2.2.2.1 Scenarios

3.2.2.2.2 Preacceptance Testing

3.2.2.2.3 Acceptance Criteria

3.3 Resources Required

GFE/GFI resources are desribed in Section 9

3.3.1 Development Tools & Resources

3.3.2 Integration & Test Resources

3.3.3 Support Resources

3.3.4 Cost and Schedule Planning

3.3.5 Project Management Tools

3.4 Product Assurance Plan

3.4.1 Configuration Management Plan

3.4.1.1 Introduction

The CM plan for this CWO is derived from and consistent with the ISDS Project CM Plan. This section is laid out in accordance with CSC SSDM Standard 6107.

3.4.1.2 Organization & Responsibilities

The ISDS PAO, is the configuration management officer (CMO). The PAO reports to management independent of the Program Manager and CWOs. The CMO performs configuration management and data activities as outlined in this CM Plan.

The Configuration Control Board (CCB) for this CWO consists of XXXX (representing both the ISDS PAO and CMO), the CWO Task Manager, the ISDS Program Manager and the JPL CWO Manager, at a minimum..

3.4.1.3 Configuration Identification

3.4.1.3.1 CI Definition

-------- Section Break before and after the table with the table being in a one column section.

Table 3.5.1.3.1-1
CWO Configuration Items

Title or Description	Versions	Notes
CWO Implementation Plan	Draft, Revised, Final	Refer to ISDS CDRL MA 005; includes plans for Software Development, Development Review, Software QA, CM, Interfaces, Software Progress Metrics, Staffing & Profile, and Cost & Schedule at a minimum
CWO Weekly Status and Major Problem Report	One/Week	Administrative data including updates to CWO status and schedule
Requirements Documentation	Draft and Final	Includes software, hardware and interface requirements documents and specifications which define the Allocated Baseline
Design Documentation	Preliminary, Detailed, Final	Includes design specifications which define the Development and Product Baselines
Source code/libraries	Internally Configured, Baselined	Source code following peer review approval and QA inspection/certification controlled by 'gatekeeper'; updated for Product Baseline
Executables	Internally Configured, Baselined	Object representation of source code following peer review approval and QA inspection/certification controlled by gatekeeper; updated for Product Baseline
Build Procedures	Draft, Final	Procedures defining software release approach
Test Plans/Procedures and Reports	Draft, Final	Includes test data for CIs, the system, acceptance, and operation
Requirements Traceability (Matrix)	Initial, Design Update, Test Update	Matrix traces requirements from system to CIs (Initial), to design documentation, then to test documentation
Training Materials	Draft, Final	Generated following completion of Operational Baseline
User Documentation	Draft, Final	Generated as part of Product Baseline
Operational Baseline/Version Deliverables	Baselined, Updates	Consists of documentation updates to the Functional, Allocated and Product Baselines and approved acceptance and operational test documentation
Discrepancy/Change Request Forms/Modifications and Repairs	As Required	This includes ECRs, SCNs, DWRs, ECOs and System Problem Reports (SPRs)

-------- Section Break before and after the table with the table being a one column section.

3.4.1.3.2 Baselines

3.4.1.4 Configuration Control

3.4.1.4.1 Change Classification

3.4.1.4.2 Change Control Procedures

Generally, they will be consistent with the overall CM plan.

Changes to this CWO shall be compliant with the change control procedures in the ISDS CM Plan. with the following exceptions:

1.

3.4.1.4.3 Change Implementation and Verification

3.4.1.4.4 Software Library Control

3.4.1.4.5 Software Support Environment Control

3.4.1.5 Configuration Status Accounting

3.4.1.6 Configuration Audits

3.4.1.7 Data Management

3.4.1.8 Configuration Management Tools

3.4.1.9 Records Collection and Retention

3.4.2 Software Quality Assurance Plan

The QA Plan for this CWO is derived from and consistent with the ISDS Program QA Plan.

3.4.2.1 Scope

3.4.2.2 Evaluation of Products

3.4.2.3 Verification of Processes

3.4.2.4 Course Correction

QA is responsible for determining when problems are not being resolved to the customers satisfaction and reporting this to the CWO manager and program manager.

3.4.2.5 Productivity and Quality Goals

3.4.3 Review Plan

3.4.3.1 Timing and Location of the Reviews

Formal reviews will be held at the IDI ISDS facility or at the JPL facility.

3.4.3.2 Notification, Agenda and Attendees

The CWO manager, XXX will be responsible for notifying JPL in advance of a proposed review and providing an agenda and list of proposed attendees.

3.4.3.3 Minutes and Action Items

The PAO is responsible for keeping minutes and action items, for posting them in the CWO database, and for routing them to the responsible parties. The responsible parties will return the proposed resolution to *CWO manager* for review and approval.

CWO manager will provide a draft set of minutes and action items within one week of the review and will continue to report the status of action items on a weekly basis to his JPL counterpart until all action items have been resolved.

3.4.4 Documents

3.4.4.1 Installation & Training Plans

3.4.4.1.1 Installation Plan

3.4.4.1.2 Training Plan

3.4.4.2 Maintenance and Sustaining Engineering Plan

3.4.4.2.1 Operational and Maintenance Requirements

3.4.4.2.2 Operational and Maintenance Procedures

3.4.4.2.3 Operational and Maintenance Guides

The operational guide is the User Manual, the Maintenance Guides the CWO name requirements and design specifications. This section merely lists the documents with its precise title and its document control number .

4. Management Approach

The management approach for this CWO is derived from and is consistent with the ISDS Program Management Plan. CWO specific items are limited to the WBS, the details of the CWO, and ...

4.1 Subcontractors

- **Computer Sciences Corp (CSC):** Infotec Development Incorporated (IDI) and

Computer Sciences Corporation (CSC) have formed a 'virtual corporation' to execute the ISDS contract. This 'virtual corporation' means there are common processes, commingled staff, and transparent parent-company identity for ISDS staff.

- Affiliates/Consultants -- Working with JPL, affiliates and consultants will be called upon as necessary to fulfill JPL requirements.

4.2 CWO Change Management

Change management for this CWO follows the process defined in the ISDS Program Management Plan and in the contract.

4.3 Tracking the Work

The ISDS team's approach to measure software development effort is based on "earned value". "Earned value" for this CWO is discussed in detail in Section nnnn.

4.4 Refine Estimates

We refine our estimates in two ways. First, earned value techniques allow us to reflect experience (for better or for worse) in one task phase into a subsequent phase. Second, cost and schedule estimation is an agenda item at each major review to make the estimates and their assumptions visible to both JPL and ISDS team, a "no surprises" approach to CWO management.

4.5 Software Progress Metrics Plan

The software progress metrics plan to Manage the CWO and to improve our processes is that describe in the project metrics plan.

5. Risk Management Plan

Risks specific to this CWO are presented in the following two tables. The first, Table 5-1, enumerates the high level risks associated with this CWO and with most CWOs.. The second, Table 5-2, enumerates the risks, impact, and the technical and managerial mitigation strategies for this CWO if the assumptions made in Section 1.3 do not hold.

In a table or in a list. For each risk show Risk Description, Affected Project Areas, Risk Tracking Method, Risk Mitigation, Decision Milestones, Risk Bounds.

Table 5-1 - High Level Risks for the CWO and How the ISDS Team Significantly Mitigates their impact on JPL

Type	Factor	CWO
known	CWO terms & conditions	Schedule
		Acceptance Criteria JPL review & approval
	Assumptions	Skill mix, Productivity Software sizing
		Technical Assumptions
potential	Commitments	GFE availability and quality
	Technical / Management	Estimates & assumptions Later expansion and elaboration of requirements
		Interpretation of requirements & specifications
		Availability of key personnel
	New technology	Adaptation required Availability
		Training required
	Knowledge loss at CWO end	Inability to respond to problems or change requests
Unknown	--	Changing funding & priorities Changing requirements
		Key personnel attrition

Table 5-2 CWO Requirements Risks, Impact, and Mitigation Strategies

CWO Assumption does not hold and ..	Impact if Risk Realized	Mitigation
Powerful GUI builder and widget library not available	Sizing estimate too small by factor of 3. Productivity estimate too high. Proposed cost & schedule impossible.	Explain our approach and its underlying assumptions and get JPL concurrence.

6. Work Breakdown Structure (WBS)

WBS	Description of Work
11	CWO management, planning, reporting, estimating
13	CWO specific Process Assurance (= CM, QA, data management)
15	Data management: Final document packaging, editing, publication preparation, and checking for completeness
31	**Delivery #1**
311	Software requirements analysis (SRR)
312	Software Design (PDR and CDR)
313	Implementation, unit test, developer integration & draft user doc't
314	Delivery #1 software maintenance while delivery 2 is in progress
32	**Delivery #2**
321	Software requirements analysis (SRR) Identify **All of existing GMC functionality which is still required.**
322	Software Design (PDR and CDR)
323	Implementation, unit test, developer integration & draft user doc't
324	Initial software maintenance
381	Program support library; e.g., `make/imake`, build tools
383	Final document packaging, editing, publication preparation
391	Independent Build test: planning, scenarios, testing, anlaysis, reporting
399	Formal & accceptance test: planning, scenarios, testing, anlaysis, reporting
5	Supporting system test
74	System Installation & checkout
75	Supporting system operation
84	Training preparation: audience identification & assessment, syllabus generation, creating lessons & training materials
85	Holding training classes

7. CWO Organization and Staffing

7.1 CWO Staff Names, Qualifications, & Availability

Erik Barkley

7.2 CWO Organization

7.2.1 CWO in the ISDS Project Organization

Erik Barkley and an ISDS staff person report to Larry Babb, the CWO manager, who reports to Kent Thomson, the project manager.

7.2.2 CWO in the JPL Organization

Duncan McCornock is the WO manager and Brian Hammer is the CDE.

7.3 Staffing Profile

TBD

7.4 Estimation Approach

7.4.1 Size Estimation

7.4.2 Underlying Assumptions for the Sizing Estimate

List each assumption.

Section xxxx, Risk Management, describes the effects on the estimates should these assumptions not hold..

7.4.3 Overall Staff Profile and Schedule

Figure nnn shows the CWO schedule. Describe the salient points of figure nnn. This is probably linked in from another application.

7.4.4 Maintenance (Sustaining Engineering) Effort

If there is a maintenance effort between builds and releases or after to final delivery, then include an estimate here.

There will be between xK and yK lines of code to maintain at each release. Using a (COCOMO defensible) number of 20000 Source Lines of Code (SLOC) per staff year and not having a significant requirement change, between nn and mm staff years per year are required for ongoing maintenance. We used *(some value between nn and mm* for....

7.4.5 Smooth the Schedule and Staff Profile

Describe any such smoothing here.

7.4.6 Apply the Staffing to the WBS

Figure xxx shows the staff members allocated to the WBS elements..

8. CWO Schedule and Dependencies

8.1 Schedule

8.2 Dependencies

Dependencies are those items outside the control of the CWO manager. We identify them here so we can plan for and manage them. Critical dependencies, if any, are included in the Risk Management Plan. There are only a few dependencies on this CWO. They are:

- JPL facilities: DTF 21 is needed to successfully deliver both releases.
- JPL support: *This is for items for which they are critically responsible*
- User availability: *When in the program and why*
- Site personnel: *When and why*
- GFE/GFI:
  1. Availability of computer and software within planned schedule.

9. GFE/GFI Items

10. Close-out Plan

This section will be supplied within 30 days of CWO closeoout.

11. Deviations, Waivers, & Exceptions

This CWO has no deviations to established standards and procedures.

12. Appendices

The appendices contain specific information related to individual CWO activities and problems. They are added sequentially to this WIP as they occur.

12.1